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The Integration of Open Educational Resources to the Mathematics Curriculum: Experiences of Students and Teachers of Secondary Education in Mexico

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Abstract. This research studied the educational context of a Mexican private secondary school to determine the requirements that open learning environments and Learning Objects Repositories must fulfill to contribute to the Mathematics curriculum. A qualitative methodology was used with a case study design. For data recollection, semi-structured interviews were administrated to the students and teachers of a private secondary school to recollect information about their experiences with the virtual repository. The implementation of digital contents repository was initially a pilot project for the subject of Mathematics, and with the results it is expected to provide a wider panorama of the students' needs and to reach the school's vision to implement the repository to other subjects. The results show that students feel motivated to learn with interactive digital resources, and they feel safety, tranquility and reassurance because the repository provides a space that contributes to their learning process; meanwhile, teachers showed evidence of their experience to plan, design, implement and monitor the activities of Mathematics.

Keywords: *open educational resources, Mathematics, learning object, basic education, Learning Objects Repositories.*

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Introduction

Globalization has caused significant technological advances in many socio-cultural spaces. The Information and Communication Technologies (ICT) offer to the educational community a plethora of didactic tools that allow the creation of alternative and recreational learning activities. Educational institutions and their teaching staffs are required to adequate the curricular contents to the use of ICT and the emerging distance education models to obtain the benefits of these new practices. In this context, Open Educational Resources (OER) offer free, open educational material available on the web (Ramírez & Mortera, 2010).

The digital wave in the field of education has modified the manner in which the educational stakeholders (institutions, teachers, parents, and students) assimilate the vast amount of information through technological resources. Nowadays, education is propelled by the incorporation and increased use of Information and Communication Technology; in this regard, one of the most important traits is the access to technological resources, which permits the union of people with no distinction of social class, color, race or country, to provide opportunities for the creation of virtual learning spaces that are flexible and free of geographic limitations. The virtual spaces provide an educational model that is referred by authors as tele-learning (Marquès, 1999), virtual education (Cabero, 2000) distance interactive education (Sandia & Montilva, 2001) or e-learning (Rosenberg, 2002).

The school "Colegio Alamos", is a private bilingual center of differentiated education, exclusive of boys, and is located in the State of Querétaro in Mexico. It offers preschool, primary, secondary and high school levels with an estimated population of 700 students; 30 students compose each class. The bilingual school offers an international program in the high school which gives the pupils the opportunity to study abroad. Various universities have certified the school, which obtained the highest scores in the Academic Performance Test at State level.

The school of this research is developing a project to seek the inclusion of educational technology to benefit the learning process of the community, and teachers have shown enthusiasm for this project of technology incorporation. The Mathematics Academy has made efforts to implement a tutoring program, which consisted of video recording where the professor explained a topic and uploaded the video to the school's web page. However, the project didn't have the expected results. Therefore, it is necessary to design and develop learning resources that support the assimilation of contents in the subject of Mathematics; the school's vision is to expand the project to other topics and levels.

Based on the above mentioned, we sought to answer the following **research question**: what are the requirements that open learning environments and learning objects repositories must fulfill to contribute to the teaching-learning process in the subject of mathematics in secondary school? The **primary research goal** is to develop a Learning

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Objects Repository in order to generate an open learning environment that allows the strengthening of the curricular contents, particularly in the subject of mathematics of second grade of secondary school in a Mexican private institution.

In addition, **the following goals** were formulated: 1) To analyze the motivational effects experienced by the students with the use of the OER in the subject of mathematics, according to their learning styles, and 2) To describe how the use of OER as a pedagogical tool modifies the perspective of teachers and students about the inclusion of technologies in their activities.

ICT offer a variety of digital resources that can incorporate into the curricular contents, and according to Gutiérrez (2008, 6) "it leads many subjects to present contents in a friendly and close manner to the students". In the Mathematics Academy of the studied institution, many efforts have been made to provide educational resources to the students for the purpose of achieving the learning objectives.

The educational field in its different levels has faced the need to adapt the curricular contents to the models and strategies of the technological era. The subject of Mathematics is considered challenging, and to achieve meaningful learning, teachers and students must adapt a pragmatic and playful attitude.

Theoretical Framework

Distance Education: roles and functions

Distance learning emerges from the need to learn during periods of change where it was not possible to attend school due to social reasons such as wars and social revolutions. Therefore, written messages and mailing were the alternatives to continue learning despite the geographical separation and age, as a solution to the access problems to study centers. Distance learning is continually transformed, since the instruction through correspondence to the beginning of the internet and online courses, use of multimedia and mobile learning. In Latin America, this modality of learning has evolved; Mexico is considered a pioneer since its beginning in 1947 through the creation of adult education centers, open learning systems, and televised education (García, 2006). Distance learning is linked to ICT, however as signaled by García (2007), every society is determined by its instruments and the way of teaching in such manner that evolution occurs according to the possibilities and interest of each group.

In relation to distance learning, we can mention blended learning, also known as b-learning, which is a scheme for primary education which offers contributions such as knowledge access to enrich the learning activities of the curricular contents (Mortera, 2010). The essential element of blended learning is the face-to-face interaction to support the comprehension and understanding of the curricular content through classroom-based and distance techniques for the creation of adequate materials (Bartolomé, 2004).

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The complexity of the ICT implementation and the enhancement of educational practices is not a linear relationship, as mentioned by Onrubia (2008), the incorporation of technological tools into education practices does not guarantee its improvement (Alvarado, Gómez-Zermeño & García, 2013). The improvement in the processes carried out in the classroom is the result of the commitment of teachers and students, and the way they face the different situations that emerge during the development of technology in class. It is necessary to accomplish an accurate analysis of the various didactic materials and educational technologies that are available for the instructional design.

Richey, Fields & Foxon (cited in Muñoz, 2010, 35) define the instructional design as the "systematic instructional planning which include an evaluation of need, development, assessment, implementation and maintaining of the materials and programs". From this perspective, the instructional design leads to the planning of substantial and founded actions in the educational labor.

To understand the relationship between the models of distance learning and learnings styles, it is necessary to study the perspective of different theories such as behaviorism or cognitivism. The former establishes that a person is stimulated by the reality that determines their behavior and learning, while the latter establishes that learning is an internal process, and the adaptation to the reality is given through mental processes.

Students have unique manners to learn, following their individual pace, methods, and strategies. As mentioned by Mortera (2010), learning styles represent the strengths and faults in the process of achieving intellectual tasks, they also represent the way in which a human being provide meaning to the experiences or information they receive. Henson & Borthwick (cited by Lozano, 2000), the authors established six different types of teaching according to different orientations: tasks, planning, students, subject, learning and emotional stimulation.

Tutoring programs are based on the constant monitoring and evaluation of the students' progress and achievements. Online environments require a closer instruction, as well as pedagogical strategies that allow self-assessment and auto-reflection (Fainholc, 2007).

According to the abovementioned, the implementation of a Learning Object Repository for the Colegio Alamos, would not only mean the incorporation of material and digital resources; it is necessary to encourage processes regarding teacher training. As pointed out by Rivero, Gómez-Zermeño and Abrego (2013), ICT can be an ally for the school and teachers, as a valuable support for teaching and learning processes.

Open Educational Resources

OER refer to didactic resources and materials that are free and available online. They are licensed for the reproduction and/or distribution for the benefit of the knowledge society, particularly professors and students of different levels (Ramírez & Mortera, 2010).

The main characteristics of the OER are accessibility, reusability, interoperability, sustainability, and metadata. The repositories often include text, video, audio and graphic

documents; their purpose is not to display the result of scientific research, but to be useful and integrated into the educational process. Another of the features is the open access and collaborative environment that allow an improvement in the quality of the teacher practice (Santos-Hermosa, Ferran-Ferrer & Abadal, 2012).

In Mexico, the implementation of Open Educational Resources has been mainly directed to higher education levels, such as universities and high schools. Nonetheless, many efforts have been made to provide this service to basic education students. The educational site and academic search engine Knowledge Hub was created as a resource with multilingual contents, which was promoted by a private higher education institute in Mexico. The main objective of this program was the establishment of a database of educational resources and learning objects; the site was originally in English, as many internet resources, to allow global access (Mortera, 2010). Knowledge Hub was then transformed into a bilingual site in Spanish and English that provides digital content from many universities in the world.

The Open Educational Resources movement in the Mexican context has provided the benefits such as cost reduction, equity, accessibility, copyrights and intellectual property, censorship, national and international knowledge barriers, interculturality, diversity and inclusion, among others (Ramírez & Mortera, 2010). However, schools face the challenge of integrating these resources to the curriculum, especially in basic education. It is considered that professors of this level are not familiar with of the use of educational resources or learning object, which can cause a problem regarding copyrights or curriculum integration (Glasserman & Ramírez, 2014). Leaning in new environments requires adapting the instruction to the needs and conditions of the context. Therefore, it is necessary to study and analyze the implementation of an OER in basic education level by collecting information about the experiences of students and teachers.

Methodology

This study is based on a qualitative methodology for the recollection of data, description and explanation of real life facts and represented as a case study. Valenzuela & Flores (2011) mention that the researchers of qualitative studies are focused on the way people interpret their experiences, how they build the reality and their signification. According to Goetz & LeCompte (cited by Bustingorry et al., 2006) the analysis of the qualitative research must be systematic and oriented to generate constructs and establish their relationship, consistent to the theory.

The socio-demographic context of the study is the Colegio Alamos, a differentiated education center for boys that located downtown in the city of Santiago, in the state of Queretaro. This school has gained respect for the academic quality and comprehensive educational offering, from preschool to high school level. The graduate students are often

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admitted to prestigious universities over the country through scholarships for academic achievement.

The research process was aimed to collaborate with the academic authorities about the selection of resources that would be offered through the repository in the school cycle 2013–2014 in the subject of mathematics of second grade, by the use of Google Sites, given the fact that the school web page is hosted by Google. The Learning Object Repository was supplied with contents by a team formed by the manager of the Mathematics Academy, the academic sub-principal and the Learning Technologies department.

The sample for this research is composed by a professor and 15 students of the second grade of secondary school in the subject of Mathematics. This small representative sample will allow a description of the reality of study (Valenzuela & Flores, 2011). The students from the sample come from families of business activities with high economic level. Their ages range from 13–15 years old, and they are bilingual, their native tongue is Spanish, and they have learned English. Most of the boys expressed to be a participant in different projects and extracurricular activities, either academic or athletic. As for the professors of the school, they work full time, and they were given iPads to accomplish the school's purpose of technology inclusion.

For the recollection of data, the instruments consisted in a semi-structured interview, and naturalistic participant observation (Salamanca & Martín-Crespo, 2007; Flores, 2008). The study was conducted during the month of July of 2014, given the fact that during that time, a training program was offered to the teachers for the following school year.

The interview was applied only to the students; it was oriented to retrieve information about how a repository could help the learning process, from the perspective of the participant students.

The observation guide was divided into two sections, one for the professor, and one for the students. The instrument included an observation scale: 0 – N/A, 1 – Deficient, 2 – Satisfactory, 3 – Good, 4 – Excellent.

The aspects that were considered regarding the professor were: knowledge about the area, knowledge about pedagogical content, teaching-learning process, critical thinking, psychological strategies, communication skills, learning assessment and educational technology inclusion. As for the students, the observed aspects were: participation, motivation, knowledge domain, motivation through digital and technological resources and academic performance.

Analysis of results

The Learning Object Repository created for Colegio Alamos, was shown to the sample of 15 students to provide them the opportunity to work with digital resources in order to strengthen the curricular content of the mathematics at the time the research was done.

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The repository was located on Google Sites, and it was created taking into consideration the characteristics proposed by Gértrudix, Álvarez, Galisteo, Gálvez & Gértrudix (2007), modularity, adaptability, reusability, interoperability and portability, and considering the aspects suggested by Gómez-Zermeño (2012), regarding the characteristics of digital content, such as quality, adequacy of the content, efficiency, practicality, and other important traits. The repository was shown in the student's native language (Spanish) containing the following sections (see Figure 1):

- Main page (login interface)
- Character of the Month: a space to share information about a character in the field of Mathematics
- Quote of the week
- Mathematics 8°(topics of the subject)
- Assignments
- Extra (information about Colegio Alamos)
- Contact (comments and suggestions)
- Bios (teachers)
- Announcements
- Calendar
- Software: links to web pages and resources for Mathematics.
- Archive: digital library to provide files to the students
- Survey: to create tests and activities.

Fig. 1. *The main page of the Mathematics Repository*

Before the application of the instruments, two phases were defined. The first one called for a meeting with the students to present the project and the possible benefits. They were given instructions for the following weeks and how to access the repository. A second meeting was conducted to review the contents and sections of the repository,

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and a third meeting to review the impressions and experiences of the repository, the comments show that they were enthusiastic about the project. The second phase consisted in the improvement of the repository to show the page in different internet browsers. The technique of triangulation was used to analyze the data from different sources and recollection methods (Hernández, Fernández & Baptista, 2010). For the analysis, it is important to remember that the sample was small because qualitative studies use a representative part of the population to provide information about the group of the study. The 15 selected students were grouped into three categories or blocks, according to the academic performance, attitude and experience in the subject of Mathematics, as presented in Table 1

Table 1. **Characteristics of the student of each group**

Participants	Academic performance	Attitudes
Block 1	Organized, methodic, doesn't show difficulties learning concepts and their grades are above the average of the group	They are respectful, interested in the subject, participate actively in class and have a good disposition.
Block 2	Their grades are satisfactory, and they comprehend the concepts, but the evaluation show low security to work in activities and solve different problems.	They tend to distract during class, they sometimes participate in class, they require constant reassurance from the professor, and they feel comfortable working in pairs.
Block 3	They have failed courses in the school year, they do not attend school several days of the year and don't submit homework on time.	They are introverted and don't participate on their initiative, they tend to have conflicts with their professors and require the help of a tutor.

Two semi-structured interviews were applied, considering the characteristics of each group, the results are presented in the categories that were obtained from both interviews with the pupils:

Perspective about Open Educational Resources and Learning Objects Repository.

Examination of the use of the digital tool to support the elaboration of extracurricular activities in the subject of mathematics.

Motivation level of the use of digital tools to contribute to their learning.

Satisfaction level of the utilization of the Learning Objects Repository for Mathematics in Colegio Alamos.

Self-assessment about the achievement of activities through the use of the Learning Objects Repository for Mathematics in Colegio Alamos.

The following section is the result of the answers obtained from the semi-structured interview to 15 students of the secondary school.

1. Perspective about Open Educational Resources and Learning Objects Repository: 6 out of 15 students expressed they didn't know what Open Educational Resources were, 7 students were aware of their purpose and only two students had a vague idea of the

concept. 53 % of the students agreed that they would like to learn math concepts in a different way, among the options they mentioned interactive digital tool and video games.

A student from block 2 answered "Yes, video games to not stay seated in the classroom." This process requires that the professor create new didactic strategies for the student to acquire significant learning through the use of technological resources. On this respect, Buendía & Martínez (2007) state that it is necessary that teachers develop abilities and skills related to the educational use of ICT.

2. Use of digital tools as a support for extracurricular activities: In relation to the frequency of use of digital educational tool in any subject, 46.66 % of students said they only used them to verify or review a particular topic. As a student from block 3 expressed: "I hardly ever use them, only when I feel the need to discuss a topic that I do not remember."

3. Motivation level obtained from the utilization of the digital tool to contribute to their learning: the results of this category allow to analyze the primary objective of this research. 86.6 % of the students confirmed they were motivated through the use of these resources, and 59 % of those students said this motivation can reinforce the activities of the class and/or study for exams.

It was evident that by persuading students without considering their levels of academic performance or attitude, technological resources for mathematics to support their learning process, provides them with enjoyment and tranquility while learning, because they feel safe to have a space that contains the class topic to consult the educational resources any time they need it, in a process of knowledge reinforcement.

4. Satisfaction level about the use of the Learning Objects Repository: All participants agreed that it was a useful tool to review the class. A student from block 2 said it provides accessibility, compared to a printed book, because OER can contain different kinds of activities. Also, another student with characteristics of block 3 mentioned that "it can help you because you can find everything we learn in class, you can save much time searching on the internet."

According to the students, the evidence show high levels of satisfaction,. As mentioned by Bates and Fitzgerald (cited by Santos-Hermosa et al., 2012), repositories provide intrinsic motivation for the students to perform the activities of the subject, which generates a link between the students and the educational center. On this respect, a student from block 1 considered that learning would be more interactive while another student from block 2 said he is in a process of adaptation to the different tools of study. An interesting observation was made by two students from block 3, who said their academic performance would improve, and that it cause a significant impact on their methods of studying, learning and comprehension.

The positive effect caused by the use of tools in a virtual learning environment, Onrubia (2008) describes it as a "support adjustment" to the educational action that helps the teaching and learning process that produce changes in the constructive mental activity that the student can develop through different learning activities.

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5. Self-assessment about the achievement in the activities through the use of the Learning Objects Repository: A student from block 1 commented "It was excellent because it makes studying easier", other students suggested improvements, for example "it is a good support for the class, but I consider that it needs to stock up with topic learned in class",

The students from block 2 said "it is very useful, it is better when it has more topics because it can explain them in a fun way, and it is easier to understand ", in addition, another student points out that "Thanks to it (OER) I can understand the topic better and I could help my tutoring student with that information".

In the context established by the student, Burgos (2004) remarks that the educational models centered on the students and distance education schemes are aimed at the creation of meaning through discoveries, comprehension, and application of knowledge, and also to share knowledge with their peers which will allow them to perfect it.

In contrast, the students who felt unsure if their learning level improve with the use of an OER are the ones from block 1, while 53.33 % said that their achievement increased with the use of open educational resources for mathematics.

Burgos (2010) says that the competencies, which students can develop in the b-learning modality, can be enriched by the incorporation of new technologies as helping resources to reinforce or generate knowledge. Among the characteristics and processes of distance education students, Garcia (2006) says that the student is the protagonist of their learning, a role that demands self-regulation in the different activities. That was evident in the collected commentaries of the structured interviews and the feedback provided by the 15 participants after the application of the instruments.

After the application of the instruments, a session was scheduled for the verification process (Valenzuela & Flores, 2011) some student of the school that were not included in the research process approach the researcher to be integrated in the selected group. This attitude confirmed that although the sample was small, most of the second-grade students of the secondary school were enthusiastic about the repository to reinforce the curricular content of mathematics.

The observation guide, which was based on the document Guide for the observation of daily classes, contains the following rubrics regarding the teacher that are described below: About the domain of the subject, the teacher shows a slight area of opportunity concerning the transversality of the contents, that is to say, the relationship between the applications of the contents to other thematic areas. About the pedagogical content, the professor showed a good performance because, during the activities, they project the use or application of the concepts to superior grades where the students will find more complex challenges.

Regarding the teaching-learning process, a dynamic class was observed, where the students work with the concepts of the class, and the teacher proposes a reflection about: What did I learn? How did I learn it? Why did I learn it?

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Regarding the development of critical thinking, teachers showed creativity while explaining a topic and encouraged the reflection about the theory. About the psychological strategies and communication skills, the professor was confident in his speech and his capacity to receive comments during class. Also, the teacher successfully maintained an effective strategy to keep the discipline in class without being severe to the students, and instead they use an assertive communication to generate trust and in this manner the students can express doubts and show respect to their authorities.

Referring to the use of different tools for the students' assessment and the evaluation of the inclusion of technologies in class, the dynamic of the group in class is based on a scheme of tutorials, which is based on the academic support among peers where one student is in charge of helping another. Pérez, Favela, López & McAnally (2005) stated that the pedagogical mediation leads the teachers to encourage the development of skills and attitudes and offer the students a variety of strategies to find, organize, comprehend and share knowledge.

The use of the repository permitted the interaction with digital resources on the web, which were an additional support to the classroom-based activities, adopting a blended learning model, as exposed by Bartolomé (2004) and Mortera (2007). The repository was oriented to be a complementary resource to the subject of Mathematics. Therefore, its instructional design was aimed to this purpose (Muñoz, 2010). As the repository is used through time, improvements can be made to strengthen the contents and increase its quality and reusability.

Conclusions

Through the research process, the following question permitted to analyze the research context: What are the requirements that open learning environments and learning objects repositories must fulfill to contribute to the teaching-learning process in the subject of mathematics in secondary school?

The repository was implemented as an extracurricular support; the teacher constantly remarked that the student should enter the repository to complete the learning activities about certain topics. As exposed by Pérez et al. (2005), the role of the teacher is to promote innovative practices in which the students can acquire and exchange knowledge and participate in their learning process.

The project of the development of a learning object repository was oriented to increase the cognitive skills of students for the subject of mathematics, as pointed out by Onrubia (2008), who says that multimedia resources allow the interaction of pupils with the concepts and motivates them to learn.

On the other hand, García (2006) express that the selection of media resources is an important procedure, which must consider the socio-institutional context, the audience,

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and the educational level. Therefore, the use of technological resources in the educational area has caused modifications of the didactic strategies to offer tools to develop competencies. Another important aspect of the research is the motivation found in sixth and seventh-grade professors, who are now interested in creating their repositories for the following school year.

In blended learning schemes, the instructional design lies in the dynamic of the activities and the abilities that students must perform successfully. On this respect, the researcher and participant students showed a good domain of the technological resources to take advantage of these tools, as signaled by Menchaca & Bekele (2008).

Open Educational Resources are digital tools that are destined to strengthen the teaching and learning process, their incorporation into the classroom generates new learning environments, and new way of communication and social interaction (Mortera, 2010). About OER, the Virtual Object Repositories are open and free of cost for their use and reuse by an educational community.

This research allowed to analyze the manner in which the inclusion of Open Learning Environments and Learning Objects Repositories support the teaching practice and contribute to the learning processes of students in second grade of secondary school in the subject of Mathematics. The analysis of the categories and indicators provided the guidelines to conduct the study. Due to limitations of computer access, the use of the repository was carried out as a reinforcement activity, additional to the topics of the Mathematic classes.

In the results, we found there was a positive and increased participation of students, compared to past academic periods. They were confident about sharing ideas due to the new method of study that allowed them to review the contents of Mathematics and study for the exams. The aforementioned is confirmed in the literature by Santos-Hermosa et al. (2012), as they mention that the use of these tools benefits the institution, teachers, and students by incorporating new manners for collaborative work and sharing experiences, saving time and effort by the re-utilization of materials.

Teachers were able to develop a Learning Object Repository through Google Sites, and students could adopt an active role and self-regulation in the learning process, as mentioned by Aiello & Willem (2004) who established that the use of ICT in blended learning models must align and combine to provide a critic transformation, related to the active participation of the student and the correct use of the repository, as an innovative practice.

The use of the Learning Object Repository permitted the observation of the different learning styles, as described by Acevedo & Rocha (2011), such as active, reflexive, theoretical and pragmatic; they converge in the classroom and promote a combination for a better learning.

About the purposes of the study, the findings were:

- The inclusion of Open Educational Resources generated an increase in the levels of motivation and confidence, according the personality of the students. The participation in the class activities increased, as well as the desire for learning. The students who were not included in the study showed interest to participate and experience new ways of learning.
- The professors have at their disposition a variety of didactic tools to optimize their classes, activities, and assessment. The dynamic of the class demands to the professor an efficient use of the technological resources, this way the students can use it outside the school environment. Through the educational innovation of the Open Educational Resources, the teacher can develop new competencies and skills, as well as the students, by using digital tools that are in accordance with the instructional design of certain subject or context.

This study can be the beginning of a series of researches that boost Open Educational Resources in schools of basic education. Through the creation of networks and communities of practice that offer space for teachers of each area of knowledge, each institution can encourage practices that favor the training of students according to their socio-cultural context. Through this investigation, it was possible to analyze how the didactic strategies relate to learning styles, to use the Open Educational Resources for the purpose of contributing to the motivation of the students.

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Atvirųjų švietimo išteklių integracija į matematikos mokymo programą: vidurinio ugdymo pakopos mokinių ir mokytojų patirtys Meksikoje

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Santrauka

Šiuo tyrimu siekta išanalizuoti, kaip atvirųjų mokymosi aplinkų ir mokymo dalykų saugyklų įtraukimas į matematikos mokymo programą sustiprina mokymo praktiką ir prisideda prie vidurinio ugdymo pakopos antros klasės mokinių mokymosi.

Šis tyrimas yra paremtas kokybine metodologija aprašant ir analizuojant realaus gvyvenimo faktus ir taikant atvejo analizės metodą. Tyrimas vyko privačiame berniukų dvikalbystės centre, įsikūrusiame Keretaro (*Querétaro*) mieste Meksikoje. Tyrime dalyvavo 1 mokytojas ir 15 vidurinio ugdymo pakopos antros klasės mokinių. Tyrimo priemonę sudarė pusiau struktūruotas interviu ir natūralus dalyvių stebėjimas.

Mokyklos sukurta mokymo dalyko saugykla buvo pristatyta penkiolikai mokinių suteikiant jiems galimybę dirbti su skaitmeniniais šaltiniais siekiant sustiprinti matematikos mokymo programos turinį. Mokymosi dalyko saugykla buvo patalpinta *Google* svetainėje. Tyrimo rezultatai atskleidė, jog atvirųjų švietimo išteklių ir mokymo dalyko saugyklos naudojimas yra perspektyvus, o skaitmeninių priemonių naudojimas yra didžiulė parama vykdant užklasines veiklas ir tai kelia mokinių mokymosi motyvaciją bei pasitenkinimą mokymusi. Pastebėtas teigiamas ir padidėjęs mokinių susidomėjimas naudojant atviruosius skaitmeninius švietimo išteklius. Pasitelkę naują mokymosi metodą mokiniai tapo labiau savimi pasitikintys kartodami matematikos dalyko turinį ir sėkmingai rengdamiesi egzaminams.

Esminiai žodžiai: *atvirieji švietimo ištekliai, matematika, mokomasis dalykas, pagrindinis švietimas, mokomųjų dalykų saugyklos.*

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